

programs now require teacher candidates to major in an academic subject. Teacher preparation programs are working with school districts to provide candidates with an additional one or two years of study, focused primarily on classroom experience. Induction programs are being developed to provide new teachers with mentors and support during their early years, when the recruits are most likely to leave the profession.

A new teacher education infrastructure is being developed. Standards for accrediting teacher preparation programs have been developed by the National Commission on Accreditation in Teacher Education (NCATE). Standards for licensing beginning teachers and guiding professional development have been formulated by the Interstate New Teachers Assessment and Support Consortium (INTASC), a collaboration of state-level staff and professional organizations concerned with teacher preparation and licensing. Standards for certifying accomplished teaching are being developed by the National Board for Professional Teaching Standards. As envisioned, these standards, aligned closely with each other and with standards for student learning, will form an integrated system that carries the prospective teacher from entry into a teaching program, through licensing and certification, through becoming an accomplished teacher, and on to lifelong professional development (Wise 1989, INTASC 1991, NBPTS 1991, INTASC 1994, Wise and Leibrand 1996, and Darling-Hammond and Ball 1997).

In addition to resolving questions about teacher qualifications, the profession also must resolve equity issues related to the quality of instruction for students in different circumstances. Poorer schools and schools with more minority students are less likely to have qualified teachers when judged by major, certification status, or years of teaching experience. Minority students are less likely to have teachers who are judged as very effective when evaluated using value-added criteria that reflect student growth in achievement (Education Trust 1998). This fact has important policy consequences. Students with the greatest need often are placed in the care of teachers who are least prepared to provide the kind of support they require (Holmes Group 1986; Oakes, Gamoran, and Page 1992; Chaney 1995; Ingersoll 1995, 1996, 1997, 1999).

## Conclusion

This chapter presented indicators of changes in U.S. elementary and secondary schools in student achievement, curriculum, instructional practices, and the teaching profession. Observations made about U.S. mathematics and science education in 1947 noted that textbooks were thick and included unnecessary information and that teachers did not have sufficient training in mathematics. Significant efforts have been made to reform elementary and secondary schools since 1947 such as those stimulated by Sputnik in 1957, the National Commission on Excellence in Education 1983, and the National Education Goals that grew out of the Governor's summit of 1990. The national policy goals and educational

standards for mathematics and science education set new and higher expectations for U.S. schools, students, and teachers. In the 1990s, NSF carried out a program of systemic reform to seek improved methods of education. The indicators in this chapter were chosen to measure how close the Nation has come to meeting those expectations.

A higher proportion of students graduate from high school having taken advanced courses in mathematics and science than did their counterparts three decades ago. As measured by the National Assessment of Educational Progress, student achievement in mathematics and science has increased since the mid-1970s, but little change has occurred since 1990. The achievement of students in most demographic groups has improved significantly since the late 1970s. Much of that improvement, however, has been in lower skill areas. There have been small increments in the proportion of students achieving at higher levels of performance, but not nearly enough to conclude that National Education Goal 3 has been well met. Many students leave elementary and middle school without strong foundations in mathematics and science. This is a particular concern when regarding black and Hispanic students who continue to perform far below their white counterparts.

The performance of females compared with males on tests of mathematics and science has changed somewhat during the past two decades. At elementary school, few significant differences in performance levels for either mathematics or science were observed in 1996, the last year NAEP was available. At middle school, no differences are detectable for mathematics, but some difference between genders exists in science. At high school, the tendency of males to outperform females is still detectable in mathematics and clearly evident in science, although the differences have been narrowing since 1977.

Among the National Education Goals is the assertion that the mathematics and science achievement of U.S. students will be first in the world by the year 2000. Fourth grade students come close to meeting this expectation in both subjects, but grade 8 and grade 12 U.S. students perform below their peers in other countries according to results collected in 1995 for the Third International Mathematics and Science Study (TIMSS).

An explicit goal of educational standards for mathematics and science is that all students—without regard to gender, race, or income—participate fully in challenging coursework and achieve at high levels. The disparate performance among racial/ethnic groups is still observed in NAEP assessments. Asian/Pacific Islander and white students are better represented in advanced courses than are black and Hispanic students. Asian/Pacific Islander and white students continue to outperform black and Hispanic students. Students of color and less-affluent students still have less access to high-end technology and less access to teachers with the proper education and certification in the subjects they teach. Although differences among ethnic groups continue, there have been important improvements: black and Hispanic students are

now taking more advanced courses in high school, their performance on mathematics and science achievement tests has improved substantially, and discrepancies among racial/ethnic groups have narrowed in some cases in the last two decades.

The role of education technology in U.S. schools has been changing rapidly. Hand-held calculators are commonly used in both U.S. homes and classrooms. About one-fourth of fourth grade teachers and three-fourths of eighth grade teachers report that they use calculators for solving complex problems. By 1998, nearly all schools reported that at least one computer was linked to the Internet and half of the classrooms had access to the Internet. Computers are less often used in mathematics classes than in other subjects. Teachers who had several computers in their classroom were the most likely to report that the Internet was of use to them for student research projects, but at the same time, only about 20 percent of teachers feel “very well prepared” to integrate technology into the subjects they teach.

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